

WHAT IS CLAIMED IS:

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1. A soft magnetic film comprising Fe, Co, a metallic element (M), and oxygen (O), the soft magnetic film being represented by a composition formula of $(\text{Fe}_{1-a}\text{Co}_a)_x\text{M}_y\text{O}_z$,

10 wherein said metallic element (M) is one selected from a group consisting of Al, B, Ga, Si, Ge, Y, Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, W, Rh, Ru, Ni, Pd and Pt,

15 said composition formula fulfills the following conditions:

$a = 0.05-0.65$;

$y = 0.2-9 \text{ at\%}$, $z = 1-12 \text{ at\%}$, and $y + z \leq 15 \text{ at\%}$; and

$x = (100 - y - z) \text{ at\%}$, and

20 a crystal structure is formed by having a bcc phase as a principal phase, the bcc phase having a crystal grain not exceeding 50 nm in diameter, and the bcc phase including a solid solution of said metallic element (M) and said oxygen (O).

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30 2. The soft magnetic film as claimed in claim 1, wherein said metallic element (M) is an alloy composed of at least two selected from said group.

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3. The soft magnetic film as claimed in

claim 1, wherein a uniaxial magnetic anisotropy is provided upon a formation thereof.

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4. The soft magnetic film as claimed in claim 2, wherein a uniaxial magnetic anisotropy is provided upon a formation thereof.

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5. The soft magnetic film as claimed in claim 1, wherein a coercive force is decreased by being annealed at a temperature lower than 300°C after a formation thereof.

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6. The soft magnetic film as claimed in claim 2, wherein a coercive force is decreased by being annealed at a temperature lower than 300°C after a formation thereof.

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7. The soft magnetic film as claimed in claim 3, further comprising an anisotropic microstructure.

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8. The soft magnetic film as claimed in

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claim 4, further comprising an anisotropic microstructure.

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9. The soft magnetic film as claimed in claim 5, further comprising an anisotropic microstructure.

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10. The soft magnetic film as claimed in claim 6, further comprising an anisotropic microstructure.

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11. The soft magnetic film as claimed in claim 7, wherein said anisotropic microstructure has a major axis shorter than 50 nm, and a minor axis shorter than said major axis.

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12. The soft magnetic film as claimed in claim 8, wherein said anisotropic microstructure has a major axis shorter than 50 nm, and a minor axis shorter than said major axis.

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13. The soft magnetic film as claimed in

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claim 9, wherein said anisotropic microstructure has a major axis shorter than 50 nm, and a minor axis shorter than said major axis.

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14. The soft magnetic film as claimed in claim 10, wherein said anisotropic microstructure has a major axis shorter than 50 nm, and a minor axis shorter than said major axis.

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15. The soft magnetic film as claimed in claim 1, wherein an electrical resistivity does not exceed 50 $\mu\Omega\text{cm}$.

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16. The soft magnetic film as claimed in claim 2, wherein an electrical resistivity does not exceed 50 $\mu\Omega\text{cm}$.

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17. The soft magnetic film as claimed in claim 1, further comprising a different magnetic film laminated on at least one of an upper surface and an under surface thereof so as to form a composite film structure.

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18. The soft magnetic film as claimed in claim 2/, further comprising a different magnetic film laminated on at least one of an upper surface and an under surface thereof so as to form a composite film structure.

19. A magnetic recording head comprising:
a soft magnetic film used in one of a whole magnetic pole and an end of said magnetic pole near a gap, the soft magnetic film containing Fe, Co, a metallic element (M), and oxygen (O) and being represented by a composition formula of $(\text{Fe}_1$
 $\text{Co}_a)_x\text{M}_y\text{O}_z$,

wherein said metallic element (M) is one selected from a group consisting of Al, B, Ga, Si, Ge, Y, Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, W, Rh, Ru, Ni, Pd and Pt,

said composition formula fulfills the following conditions:

$a = 0.05-0.65$;
 $y = 0.2-9 \text{ at\%}$, $z = 1-12 \text{ at\%}$, and $y + z \leq 15 \text{ at\%}$; and
 $x = (100 - y - z) \text{ at\%}$, and

a crystal structure is formed by having a bcc phase as a principal phase, the bcc phase having a crystal grain not exceeding 50 nm in diameter, and the bcc phase including a solid solution of said metallic element (M) and said oxygen (O).

20. The magnetic recording head as claimed in claim 19/, wherein said metallic element

(M) is an alloy composed of at least two selected from said group.

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